

(19) World Intellectual Property Organization  
International Bureau



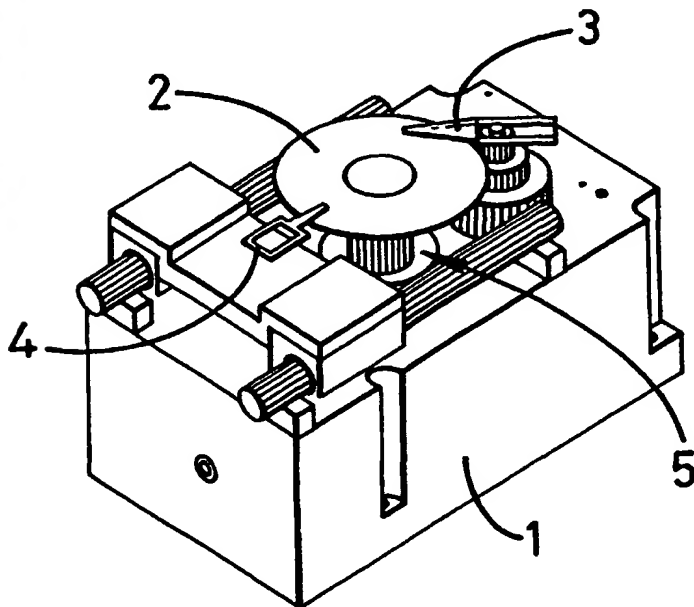
(43) International Publication Date  
29 March 2001 (29.03.2001)

PCT

(10) International Publication Number  
WO 01/22410 A1

- (51) International Patent Classification<sup>7</sup>: G11B 5/596 (74) Agents: FAULKNER, Thomas, John et al.; 1J Cleveland, 40-43 Chancery Lane, London WC2A 1JQ (GB).
- (21) International Application Number: PCT/GB00/03414
- (22) International Filing Date: 6 September 2000 (06.09.2000)
- (25) Filing Language: English
- (26) Publication Language: English
- (30) Priority Data:  
9922238.2 20 September 1999 (20.09.1999) GB  
0010272.3 27 April 2000 (27.04.2000) GB
- (81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.
- (84) Designated States (*regional*): ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).
- (71) Applicant (*for all designated States except US*): WEST-WIND AIR BEARINGS LTD. [GB/GB]; Holton Road, Holton Heath, Poole, Dorset BH16 6LN (GB).
- (72) Inventors; and
- (75) Inventors/Applicants (*for US only*): GERRARD, Christopher, Paul [GB/GB]; 190 Salisbury Road, Burton, Christchurch, Dorset BH23 7JS (GB). POWELL, Robin, John, William [GB/US]; 2352 Mattos Drive, Milpitas, CA 95035 (US).
- Published:  
— With international search report.
- For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

(54) Title: MANUFACTURE OF DATA STORAGE DEVICES



(57) Abstract: A device and method for preparing media discs (2) in which servowriting and verification of the media may be carried out simultaneously. A common monolithic platform (1) is provided which supports air bearing systems which allow movement of a media disc rotary carrier (5), a servowriting headstack (3) and certifier headstack (4). Indirect drive may be provided to the rotary carrier (5) via coupling means (62).

WO 01/22410 A1

date  
not  
good

## Manufacture of data storage devices

This invention relates to the manufacture of data storage devices such as magnetically and optically written discs. Examples are hard and floppy  
5 magnetic discs as used in personal computers where the data is written in magnetically as well as CD ROMs which normally have data written in optically, i.e. usually by laser beam.

The invention relates specifically to the stage of manufacture of the storage  
10 device where indexed tracks or sectors are created. These are necessary so that the data recording and reproducing systems can identify the location of data put into and read out from the storage device. Moreover for high quality performance these indexed tracks or sectors have to be very accurately provided on the storage device.

15

This manufacture involves separate stages wherein the media is examined (certified) and written to (servo written). Current practice requires separate discrete pieces of equipment to perform these tasks at separate stages of manufacture.

20

The tasks all require the rotation of the media disc with extreme quality of

motion while magnetic or other heads and sensors are moved across the surface with controlled motion, positional relationships and geometry. In this regard there are normally two separate units, one of which, generally referred to as a servo-writer writes the sectors to the disc, and the other, generally referred to as a verifier, verifies the surface(s) of the disc, usually optically.

The aim of this invention is to provide a particularly accurate and simple arrangement for performing these tasks, and accordingly the invention provides a single platform with the ability to carry all the systems required to perform these tasks, particularly to both verify the surface and write the sectors, at one stage within the manufacturing process.

Accordingly one aspect of the invention comprises a single monolithic support platform, a rotary carrier arranged for rotation of a media disc supported on said platform, a write head arranged for substantially radial movement relative to said carrier and for servo writing of data to said media disc and a certifier head arranged for substantially radial movement relative to said carrier and for verification of the media disc.

For the ultimate in quality of motion some or preferable all such motion systems should be carried on air bearings. In a preferred construction the

mountings for all of these air-bearing systems should be a single and solid component incorporating the maximum rigidity providing a common datum for each discrete process.

- 5 Accordingly a preferred form of the present invention utilises a single body to carry all the air bearing systems required to perform all the processes needed for the media to be installed in a disc drive or other data storage device. All motion systems thus contained can then be capable of simultaneous operation.
- 10 Respective drive means are typically provided for driving each of the moving components, namely, the rotary carrier, the write head and certifier head. One or more of the drive means may comprise an integrated motor which is arranged for directly driving a rotary spindle, or other member, supporting the respective component. Providing integrated drive means eases manufacture and
- 15 alignment of the constituent parts of the device.

One or more of the drive means may be an indirect drive means comprising a motor which is mounted independently of the respective component, and coupling means for transferring the drive to the respective component whilst

20 minimising the transmission of any undesirable vibration. In some embodiments, the coupling means may be a resilient coupling means disposed

in substantially axial alignment with a rotary spindle of the respective component. In other embodiments, the coupling means may comprise a drive belt.

- 5 It is particularly preferred that indirect drive means are provided for driving the rotary carrier carrying the media disc. The use of indirect drive means can allow substantial mechanical isolation of the motor from sensitive parts of the device. In particular, the indirect drive can help to prevent harmful vibrations being transmitted to the media disc or the servowriter head, which might
- 10 otherwise cause track errors.

According to another aspect of the invention there is provided a method as defined in Claim 11.

- 15 According to yet another aspect of the invention there is provided a method as defined in Claim 12.

According to a further aspect of the invention there is provided a method as defined in Claim 13.

Embodiments of invention will now be described, by way of example only,  
with reference to the accompanying drawings in which:

Figure 1 shows a perspective view of a combination magnetic disc servowriter  
5 and certifier platform;

Figure 2 is a schematic side view of part of the platform shown in Figure 1,  
the platform being partly shown in section; and

10 Figure 3 is a schematic side view of part of an alternative platform, the  
alternative platform being partly shown in section.

Referring particularly to Figure 1, in a first embodiment, a common monolithic  
platform 1 is provided in the form of a single piece of material integrally  
15 forming a base support for three separate air bearing motion systems thereby  
guaranteeing the positional relationship of each to the media being processed.  
This media in the form of a magnetic disc 2 is mounted on a motorised  
spindle 5 with integral position feedback and disc clamping.

20 A servowriting headstack 3 is mounted on a rotary spindle carried by an air  
bearing and is geometrically positioned in relation to the media spindle 5 so

as to mimic the final data storage product take off read-rotation relationship. It is fitted with an integral accurate motion actuator and fittings for a separate position sensor. The monolithic platform 1 acts as a spindle block for both the disc carrier and the servowriting headstack spindles.

5

A certifier headstack 4 is mounted on a linear air-bearing supported slide with integral linear motor and fittings for a separate position sensor. However, this motion system could also be of rotary design. In such a case the monolithic platform would also act as a spindle block for the certified headstack spindle.

10

Figure 2 is a schematic side view of part of the device shown in Figure 1, part of the platform 1 being shown in section to more clearly show the motorised spindle 5 used for carrying the magnetic disc 2. The magnetic disc 2 and selected other parts of the device are omitted in Figure 2 for the sake of simplicity.

15

The motorised spindle 5 generally comprises a rotary spindle or shaft 51 mounted in an air bearing 52 for rotation and axially supported by an axial bearing 53. Rotational drive of the rotary spindle 51 is provided by an integral motor. The integral motor comprises a stator 54 and a rotor 55 which carries a plurality of permanent magnets 56 and which is formed integrally with the

20

rotary spindle 51. Thus a direct drive is provided to the rotary carrier of the magnetic disc 2. It can be noted that all of the rotary carrier, the servowriting headstack and certified headstack are mounted on the support platform 1.

- 5 Figure 3 is a schematic side view of part an alternative embodiment. The alternative embodiment is similar to that described above except that the rotary carrier of the magnetic disc is indirectly driven. Again, in Figure 3, part of the platform 1 is shown in section to more clearly show the motorised spindle 5, whilst the magnetic disc 2 and selected other parts of the alternative device are  
10 omitted for the sake of simplicity.

In the alternative embodiment, the motorised spindle 5 similarly comprises a rotary spindle or shaft 51 mounted in an air bearing 52 for rotation and axially supported by an axial bearing 53. However rotational drive of the rotary  
15 spindle 51 is provided by an independent motor 6. The independent motor 6 is mounted on the support platform 1 but independently of the rotary spindle 51. Drive is transferred to the rotary spindle by way of a pair of pulleys 61 and a drive belt 62. Thus an indirect drive is provided to the rotary carrier of the magnetic disc 2 which can help to avoid undesirable vibrations being  
20 transmitted to the media disc or servo writing headstack.



In alternatives, a different form of drive coupling may be provided between an independent motor and the rotary carrier of the magnetic disc. This may take the form of a resilient solid or a fluid based coupling. Typically such a coupling will be disposed in alignment with both the axis of the rotary carrier  
5 and the axis of the motor.

In other alternatives, the independent motor in an indirect drive device can be mounted externally, and/or entirely independently of the monolithic platform block.

10

In further alternatives, one or more of the motion systems may not be of an air bearing design but some form of mechanical device.

In operation of any of the embodiments described above, a newly machined  
15 and finished disc or stack of discs will be loaded onto the media spindle disc clamp, after which the spindle will spin up to the operating speed. The servowriting and certifying tasks are completely independent and may be carried out in any order or simultaneously. However, the certifying process, which is typically an optical examination of the disc surfaces, can be conducted  
20 much more quickly (in the order of 20 seconds) than the servowriting (say 20 minutes). Thus it is sensible to either certify first or simultaneously with the

start of the servowriting process. Preferably the servowriting and certifier headstacks will start their motion simultaneously allowing the integrity of the medium to be confirmed and the servo pattern to be written onto the disc. If the certifier identifies a faulty disc the process will be stopped and the disc  
5 discarded. After the process is complete the media will be ready for assembly into a disc drive or other data storage device. Using a device of the type described herein, it is possible to achieve track densities in the order of 40,000 tracks per inch.

10 Although not described in detail, systems similar to those described and within the scope of the present invention can be used for processing other types of media discs.

## CLAIMS:

1. A device for preparation of a media storage disc comprising a single monolithic support platform, a rotary carrier arranged for rotation of a media disc supported on said platform, a write head arranged for substantially radial movement relative to said carrier and for servo writing of data to said media disc and a certifier head arranged for substantially radial movement relative to said carrier and for verification of the media disc.  
5
2. A device according to Claim 1 in which the rotary carrier, the write head and the certifier head are all carried on air bearing systems.  
10
3. A device according to Claim 2 in which mountings for each of said air bearing systems are formed within said single monolithic support platform, thereby ensuring a common datum for both writing to and verifying the disc.  
15
4. A device according to any preceding claim comprising indirect drive means for driving the rotary carrier, the drive means comprising a motor mounted independently of the rotary carrier, and coupling means for transmitting the drive to the rotary carrier whilst minimising the transmission of  
20 any undesirable vibration.

5. A device according to Claim 4 in which the coupling means comprises a resilient coupling means disposed in substantially axial alignment with the rotary carrier.
- 5 6. A device according to Claim 4 in which the coupling means comprises a drive belt.
7. A device according to any one of claims 1 to 3 comprising indirect drive means for driving the rotary carrier, the drive means comprising a motor  
10 mounted independently of the rotary carrier, and a drive belt for transmitting the drive to the rotary carrier.
8. A device according to Claim 2 or Claim 3 in which at least one of the air bearings comprises a rotary spindle, and associated indirect drive means is  
15 provided for driving the spindle, the drive means comprising a motor mounted independently of the respective spindle and coupling means for transmitting the drive to the respective spindle whilst minimising the transmission of any undesirable vibration.
- 20 9. A device according to Claim 2 or Claim 3 in which at least one of the air bearings comprises a rotary spindle, and associated indirect drive means is

provided for driving the spindle, the drive means comprising a motor mounted independently of the respective spindle and a drive belt for transmitting the drive to the rotary spindle.

5 10. A device according to any preceding claim which is arranged for writing to and verifying a hard or floppy magnetic disc or a CD Rom.

11. A method of preparing media storage discs comprising the steps of mounting a media disc on a rotary carrier supported on a platform,  
10 servowriting data to the mounted media disc with a write head and verifying the mounted media disc using a certifier head without removing the media disc from the rotary carrier between the servowriting and verifying steps.

12. A device for preparation of a media storage disc comprising a single  
15 monolithic support platform, a rotary carrier arranged for rotation of a media disc supported on said platform, a write head arranged for substantially radial movement relative to said carrier and for servo writing of data to said media disc and indirect drive means for driving the rotary carrier, the drive means comprising a motor mounted independently of the rotary carrier, and coupling  
20 means for transmitting the drive to the rotary carrier whilst minimising the transmission of any undesirable vibration.

13. A device for preparation of a media storage disc comprising a single monolithic support platform, a rotary carrier arranged for rotation of a media disc supported on said platform, a certifier head arranged for substantially radial movement relative to said carrier and for verification of the media disc
- 5 and indirect drive means for driving the rotary carrier, the drive means comprising a motor mounted independently of the rotary carrier, and coupling means for transmitting the drive to the rotary carrier whilst minimising the transmission of any undesirable vibration.
- 10 14. A device according to Claim 12 or Claim 13 in which the coupling means comprises a resilient coupling means disposed in substantially axial alignment with the rotary carrier.
- 15 15. A device according to Claim 12 or 13 in which the coupling means comprises a drive belt.
16. A device according to any one of Claims 12 to 15 in which at least one of the rotary carrier, the certified head and the write head is carried on an air bearing.
- 20 17. A device for preparation of a media storage disc comprising:

a single monolithic support platform, a rotary carrier supported on said platform and arranged for rotation of a media disc on an air bearing system, the carrier being driven by a motor mounted independently of the rotary carrier and arranged to drive the carrier via resilient coupling means; and

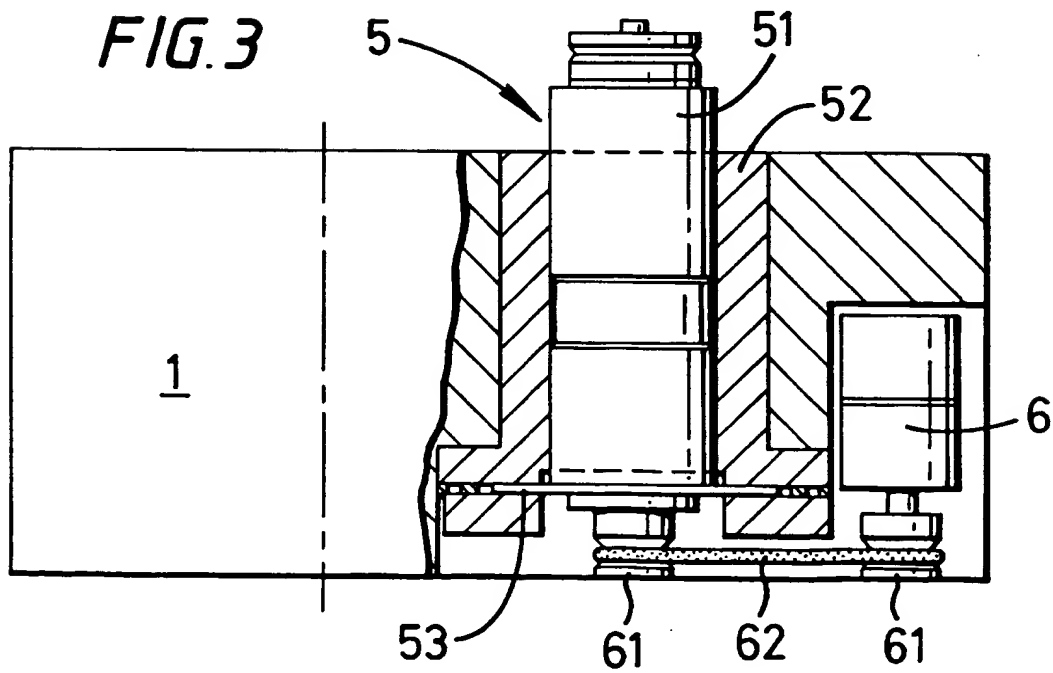
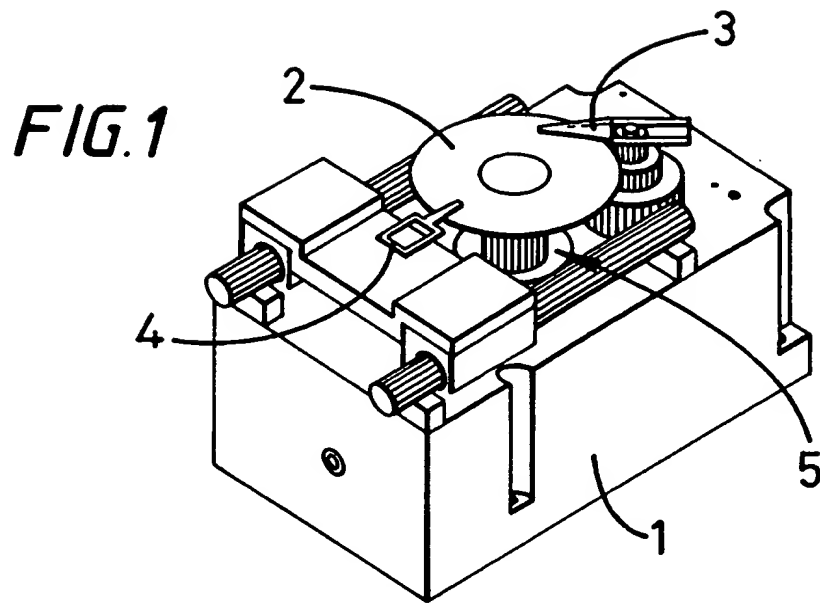
5           a write head arranged for substantially radial movement relative to said carrier and for servowriting of data to said media disc, the write head being carried on an air bearing system.

18.    A device for preparation of a media storage disc comprising:

10           a single monolithic support platform, a rotary carrier supported on said platform and arranged for rotation of a media disc on an air bearing system, the carrier being driven by a motor mounted independently of the rotary carrier and arranged to drive the carrier via a drive belt; and

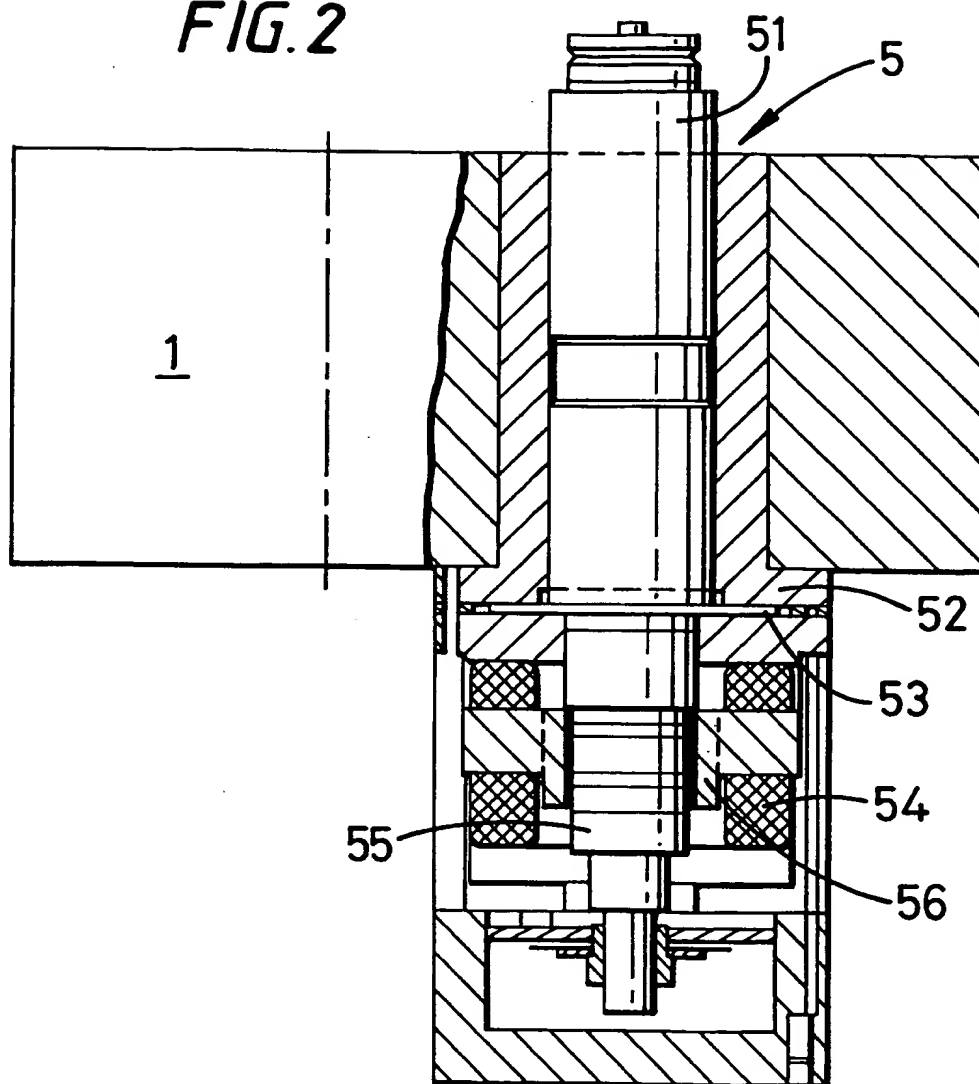
          a write head arranged for substantially radial movement relative to said  
15 carrier and for servowriting of data to said media disc, the write head being carried on an air bearing system.

1/2





2/2

**FIG. 2**

# INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/03414

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 G11B5/596

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 G11B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 321 942 A (KONISHIROKU PHOTO IND) 28 June 1989 (1989-06-28)	1-3, 11-13, 17,18 5,6
A	column 4, line 18 -column 7, line 14; figure 6 column 8, line 54 -column 9, line 52	
X	US 5 642 943 A (SZEREMETA WALLY) 1 July 1997 (1997-07-01)	1,11-13, 17,18 5,6
A	column 6, line 28 -column 11, line 32	
X	US 5 909 333 A (LEE CHIH-KUNG ET AL) 1 June 1999 (1999-06-01)	1
	column 5, line 52 -column 7, line 46	
X	US 3 875 589 A (APPLEQUIST ROY A ET AL) 1 April 1975 (1975-04-01)	1
	column 2, line 58 -column 6, line 13	
	-/-	



Further documents are listed in the continuation of box C.



Patent family members are listed in annex.

### \* Special categories of cited documents :

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*&\* document member of the same patent family

Date of the actual completion of the international search

19 December 2000

Date of mailing of the international search report

28/12/2000

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Ressenaar, J-P

## INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 00/03414

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 193 084 A (CHRISTIAENS ALOIS E) 9 March 1993 (1993-03-09) column 3, line 15 -column 4, line 55	1
X	US 5 760 989 A (COLBAN DAN) 2 June 1998 (1998-06-02) column 2, line 66 -column 4, line 47	1
X	US 4 980 783 A (MOIR MICHAEL B ET AL) 25 December 1990 (1990-12-25) column 7, line 37 -column 20, line 14	1
X	GB 2 330 189 A (HAVANT INTERNATIONAL LTD) 14 April 1999 (1999-04-14) page 5, line 22 -page 9, line 24	1
A	US 4 920 434 A (BROWN DAVID A ET AL) 24 April 1990 (1990-04-24) column 5, line 61 -column 9, line 59	1,11-13, 17,18
A	US 5 894 374 A (MORARU ALEX) 13 April 1999 (1999-04-13) column 3, line 26 -column 4, line 49	1
A	US 4 920 442 A (DIMMICK WALTER S) 24 April 1990 (1990-04-24) column 3, line 50 -column 5, line 17	1
A	US 5 617 267 A (KAWAGOE SEIJI ET AL) 1 April 1997 (1997-04-01) column 8, line 23 -column 11, line 18	1
A	US 5 786 963 A (MALEK SATTAR S) 28 July 1998 (1998-07-28) column 7, line 45 -column 10, line 31	1
A	US 5 627 698 A (MALEK SATTAR S) 6 May 1997 (1997-05-06) column 6, line 23 -column 9, line 67	1

# INTERNATIONAL SEARCH REPORT

information on patent family members

International Application No

PCT/GB 00/03414

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0321942 A	28-06-1989	US 5177651 A JP 1213871 A	05-01-1993 28-08-1989
US 5642943 A	01-07-1997	NONE	
US 5909333 A	01-06-1999	AT 172571 T BR 9502512 A CA 2144403 A CN 1126874 A DE 69505524 D DE 69505524 T WO 9533262 A EP 0761002 A JP 7326142 A KR 207879 B RU 2141691 C SG 30328 A	15-11-1998 09-04-1996 28-11-1995 17-07-1996 26-11-1998 02-06-1999 07-12-1995 12-03-1997 12-12-1995 15-07-1999 20-11-1999 01-06-1996
US 3875589 A	01-04-1975	DE 2455142 A JP 50129207 A	09-10-1975 13-10-1975
US 5193084 A	09-03-1993	NL 8902819 A DE 69017841 D DE 69017841 T EP 0428218 A JP 3054432 B JP 3176857 A	03-06-1991 20-04-1995 12-10-1995 22-05-1991 19-06-2000 31-07-1991
US 5760989 A	02-06-1998	NONE	
US 4980783 A	25-12-1990	NONE	
GB 2330189 A	14-04-1999	JP 11219573 A SG 70131 A	10-08-1999 25-01-2000
US 4920434 A	24-04-1990	US 4396959 A US 4872074 A US 4982296 A DE 3137701 A FR 2490857 A GB 2083926 A,B HK 93885 A JP 57086910 A SG 64185 G US 4814909 A US 4490635 A US 4660106 A US RE32075 E US 5119254 A	02-08-1983 03-10-1989 01-01-1991 06-05-1982 26-03-1982 31-03-1982 29-11-1985 31-05-1982 02-05-1986 21-03-1989 25-12-1984 21-04-1987 28-01-1986 02-06-1992
US 5894374 A	13-04-1999	NONE	
US 4920442 A	24-04-1990	NONE	
US 5617267 A	01-04-1997	JP 3064837 B JP 7230678 A	12-07-2000 29-08-1995
US 5786963 A	28-07-1998	US 5627698 A	06-05-1997

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 00/03414

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5627698 A	06-05-1997	US 5786963 A	28-07-1998